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ABSTRACT

Descriptions are presented of three programs whose primary purpose is to teach students to think more efficiently, that is, to develop habits of critical thinking, and to improve decision-making and problem-solving skills. One of the three programs operates at Bowling Green State University and seeks to develop skill in critical analysis by focusing on social issues (e.g., nuclear power, school and religion, and political expression) to stimulate class discussion and supplement regular written assignments. The approach is interdisciplinary and includes values clarification and development of communication skills. Another program, conducted at Piedmont Technical College, focuses on teaching students to analyze everyday problems, particularly those from their own experience. The courses provide a method of problem analysis based on seven factors: identifying the real problem, the risks, alternatives, goals, values, information needed, and constraints on action. In contrast to these two programs, the Development of Operational Reasoning Skills Program (DOORS) at Illinois Central College provides a teaching technique rather than a specialized curriculum. The technique is based on the learning theories of Piaget and others and is applied to six traditional subject-matter areas, specifically English, mathematics, physics, history, sociology, and social science. (DR)

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TEACHING THINKING: THE FORGOTTEN FOUNDATION OF EDUCATION

FORUM 17

59th Annual AACJC Annual Convention

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April 30, 1979

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TEACHING THINKING: AN INTRODUCTION

by

Norman Murphy

This document contains descriptions of three programs whose primary purpose is to teach students to think more effectively. People and institutions involved in these projects have looked at institutional and societal costs incurred by students' handicaps in thinking (or solving problems, making decisions, or whatever label one uses for this skill) and decided that there was a significant need to design educational programs to help increase the competence of students in thinking.

To understand these programs, it is important to know some specific consequences of the inability to think clearly. Considerable institutional costs maybe traced to this lack of competence. First, there are numerous and familiar learning problems directly related to poor thinking skills. Some of them are

- an inability to ask a series of perceptive and related questions,
- an inability to integrate information from varied sources and types,
- an inability to recall relevant knowledge,
- an inability to solve unfamiliar or complex problems,
- a difficulty with basic communications and computation skills,
- an unwillingness to take responsibility for their own learning and achievement,
- an inability/unwillingness to apply prior learning to current/different activity, and
- an inability to systematically take in, organize, and build on learned facts.

Institutionally, the cost of these problems is considerable. One obvious cost if the amount of time required to "re-teach" content after it has once been taught. Time spent in ineffective educational practices becomes even more costly as the amount of knowledge continues to increase rapidly and colleges feel pressures to restrict costs by reducing offerings. The rapid increase in remedial and developmental programs is another very significant cost. The experience of Piedmont, for example, indicates the inability to think is probably at the core of the learning problems of many students.

Consequences of people having poor thinking skills are also abundantly present in problems related to employee performance, community activities, and personal affairs. These include the inability

- to easily be given tasks with many or any unfamiliar/ambiguous aspects;
- to react effectively to unexpected problems or demands on the job;
- to deal productively with fellow workers, supervisors, etc.;
- to rarely take much initiative, see the larger "corporate picture," or plan ahead, etc.;
- to make intelligent consumer, budgetary, etc. decisions;
- to break the habit of always choosing only the solution which seems simplest and easiest;
- to deal in healthy ways with family, friends, authorities, etc.; and
- to see beyond their own immediate, personal desires/benefits.

If the social costs of incompetent thinking are difficult to measure, they are equally familiar.

Programs described in this document are responding to the needs derived from this analysis. These programs share three basic premises:

1. Teaching thinking is important for students, faculty, and colleges.
2. The same or similar thinking skills are useful in academic, personal, career, and civic situations. These thinking skills include the ability to
   - organize information,
   - generate alternatives,
   - manipulate cause and effect, and
   - exclude irrelevant variables.
3. Thinking can be taught -- in many ways, as implied by the diversity of the programs presented in this document.

Following is a capsulized description of the programs presented in this paper. Only the most salient features are mentioned.

Bowling Green State University -- Jim Litwin

This program seeks to develop skills in critical analysis by using social issues as grist for class discussions and homework assignments. The approach is interdisciplinary, combining critical thinking with a study of values and the development of communication skills.

Piedmont Technical College -- Curtis Miles

This program focuses on teaching students to analyze everyday problems (from career, academic, and personal settings), especially those that correspond to life experiences they have had or can imagine. The content, thus, does not come from the traditional academic disciplines.

Illinois Central College -- Thomas Campbell

In contrast to the previous two programs, the DOORS Program provides a method of teaching the traditional subject matter of the disciplines in the arts and sciences, but with the specific purpose and plan to improve thinking skills of students. The actual instructional procedures are based on a specific theory of how people develop the ability to think or reason.

In examining these programs and thinking how they might relate to your institution, it will be particularly helpful to keep the following points in mind.

1. These programs are replicable in a variety of settings.

   The programs described originated in three very different institutions: a technical college, a community college, and a state university. The panelists' perception of the acceptability of each program at the other two institutions provide evidence of their replicability:

   a. The Illinois Central model would work at Bowling Green as well as Piedmont.

   b. The Piedmont model would be acceptable at Illinois Central and to students at Bowling Green. Faculty, however, would not find it sufficiently "academic".

   c. Bowling Green's program would be acceptable at Illinois Central and to the Piedmont faculty. Piedmont students, however, would balk, finding the approach unrelated to their educational goals.

2. Each institution must develop its own program -- there are many ways.

   While an ever increasing body of theoretical literature and empirical research is available for use in designing a program, there is insufficient data to affirm one way of teaching thinking is better than another. Each institution must find its own way to accomplish each of the following:

   - build on the interests and strengths of faculty,
   - consider the educational goals and interests of the students,
   - be consistent with the mission of the institution,
   - incorporate desirable elements of other programs, and
   - add features of its own.

3. Administrative support is critical for the successful implementation of a program to teach thinking skills.

Of course providing the personnel, space, supplies, and assistance with scheduling is required. Beyond these mundane but important items, another level of support is absolutely essential. Administrators must be aware of the complexity of the task and have realistic expectations about what can be accomplished. Further, an administrator who would facilitate a project of this nature must be willing to ask the tough questions when the inevitable opposition surfaces. Standard objections include "I'm doing it already," "I've tried that and it didn't work," and "emphasizing thinking skills will dilute the content of my course." Normally, of course, some precise questioning coupled with a persistence about seeing evidence, e.g., syllabi tests, learning packages, etc., will probably indicate people are not doing it nor have they tried and failed.

It is true, though, that a teacher cannot cover as much material in a "thinking" course as opposed to a traditional lecture course. The trade off is rather clear, however. There is substantial evidence to indicate that a person who is taught to think in conjunction with the traditional subject matter, e.g., history, math, psychology, etc. will retain the knowledge much longer and be more competent in using it in other settings, such as the next course or outside of school.

The panelists affirm the importance of teaching thinking skills explicitly because it is important for institutions and students alike.

It is important for an institution

- to be sure that learning and program outcomes are related to societal needs;
- to spend instructional time teaching information that is important to students and society, not just a particular teacher; and
- to teach students generic skills that are useful in various adult roles such as student, employee, and consumer.

It is important for students

- to retain subject matter longer;
- to apply knowledge gained in one course in succeeding courses, or on the job;
- to process and make sense of vast amounts of information received through conversation, television, newspaper, books, and periodicals; and
- to have the skills to grapple with moral, technical, and everyday problems.

The following program descriptions indicate what three institutions are doing to respond to these needs.

TEACHING THINKING: THE LITTLE COLLEGE AT BOWLING GREEN

Presented at the American Association of Community
and Junior Colleges Meeting, April 1979

James L. Litwin, University Division of General Studies
Bowling Green State University, Bowling Green, Ohio

Should more nuclear power plants be built in the midwest? Is it right that some parents prefer to teach their children at home instead of sending them to school? Can "Jonestowns" be prevented through the accreditation of religion by government? Should the Nazis be allowed to march in Skokie? The answers to these questions are obvious -- YES and NO.

These are the kinds of topics and questions that make up the daily like of students and faculty members in the Little College. They are what we struggle with in class and what we take home with us and bring back the next day and the next. However, there's another level of questioning that also concerns us. What evidence does the author offer for his/her position on these issues? What fallacies are involved in their reasoning? What information do we need to have? How is language being used? What are alternative solutions to these problems? What are the consequences associated with the alternatives? The pursuit of this latter set of questions in a systematic fashion represents the method by which we attempt to develop critical thinking skills in college freshmen.

The Little College will be entering its ninth year next fall. I'm convinced it's needed now more than ever. Although the program developed at the turn of the decade, it was not a product of student discontent or Kent State or affirmative action. It was the product of a certain concept of liberal education that caught the imagination of a group of instructors who believed that college, above all, must provide basic capabilities to students must read, write, and compute, the Little College founders also believed students must have the intellectual capacity to consider the images which form their world and their own thinking about that world and themselves.

The course has gone through some interesting evolutions. It began as an interdisciplinary course (called "Images") with a disciplinary-based sequel. Some tried to make it into a formal logic course. It ventured into the land of heuristics for a time. For the last several years, though, the Little College has settled down to a combination critical thinking course using social controversies and a values analysis course. Not surprisingly, these components are called Evaluating Social Controversies (five credits) and Values Analysis (two credits). The objectives of the courses remain close to the original set. In my own section of the Little College, for example, I paraphrase liberally from Wayne Booth (from an essay called "Is There Any Knowledge That a Man Must Have?): "No one thinks for himself very much of the time or in very many subjects. Yet the habitual effort to ask the right critical questions and to apply rigorous tests to our hunches is a clearer mark than any other of an educated man."

The Little College serves mostly first quarter college students. The major assumption we make by encouraging this is that the course pays rich dividends during the rest of one's college tenure. You will need and use these reasoning skills all the time, we say. Sadly, this isn't true. Students have found little opportunity to exercise these skills in other classes. They usually adjust to the routine though. What choice is there? They learn to be content with the fact that many instructors prefer that it not be known that human knowledge is fragile and often debatable, that controversy and discussion can be the exciting stuff of college, that thinking is an active process.

The Little College has usually done well by its students. Test results on standard instruments like the Watson Glaser show improvement in student abilities. Our own Little College Rubric Exam shows marked improvements can occur even among students who enter college with higher than average intellectual orientations. I would like to share some of the key elements of the teaching-learning process with you in the rest of the paper.

A. The content of the course (i.e., topic selection) is interesting. Even in an age when students define everything not related to their major as a waste of time, many students find the questions posed earlier to be of some interest. The trick in the social controversies class is to help the student understand that most "current events" questions are usually tied to some fundamental issues, e.g., individual freedom. The values course uses anthropological case studies and political belief systems. By its focus on value systems and the analysis of associated consequences, the course keeps a healthy distance from values "clarification" approaches aimed at self-improvement.

B. Class activity is intense and the workload is heavy (which creates a problem when Little College students find out what their roommates are doing). The class sections take on a workshop-type atmosphere. Nearly every class has an assignment due and weekend papers and the norm. The quarter starts by having students take topics and turn them into questions, questions that have two or more answers. The students' own answers are usually not requested until later in the quarter. When they are, the answer itself is not graded. How the student put the answer together is graded.

Faculty push, cajole, direct, and encourage students. The classes involve risk for faculty -- you must be able to say "I don't know." You must think on your feet (prepared notes are never sufficient) and, on occasion, graciously accept a student's answer as better than your own. The rewards are immense for those who believe and you've got to believe to stay with the program.

C. The Little College Rubric is helpful. The Little College Rubric is our final exam, but it also guides the course. Each part of the course is devoted to developing a skill which will be requested on the final exam. Therefore, the final exam in the agreed-upon set of course objectives. Students receive the final exam guidelines when they receive the syllabus. As long as they put in the hours of practice required, they do quite well. What doesn't make sense during the quarter, usually makes sense when the final exam is written. The Little College Rubric is an explicit set of instructions for analyzing two or more arguments on the same topic and deriving and defending your own conclusion. The Rubric exam is graded by at least two instructors (neither of whom may have had the student in class). This tactic provides a degree of uniformity to the classroom experience, reduces certain grading biases, and to a degree, promotes healthy competition amongst both students and faculty.

Yes, there are problems. Main among these is that there is too much material to pack into 10 weeks -- a semester would be better, or we could have a sequel like the movies do. Also, a 7-credit program doesn't fit into students' schedules easily. When students find out how happy other students are with less work and more partying, there's normally a morale problem, but it can be partially controlled by enthusiastic faculty constantly telling them the Little College is worth it. Mostly, this is controlled by self-selection.

The course has a good reputation on campus. However, philosophers feel a good course in logic would do as well. Mathematicians feel a good course in math (probably algebra or calculus) would do as well, etc., etc. We don't disagree, perhaps a good course in those and other topics would do as well. We are convinced though that the Little College does work and is desperately needed given the present unmanaged general education curriculum. Ironically, the nastiest quarrels we have are with conventional arts and sciences folks -- those who prefer to define learning as a set of exposures and the supposition that (a) some students will benefit from such an approach, (b) some will mature in spite of the course, and (c) others will simply disappear. We think general and liberal education should be taken more seriously than that. Faculty in the Little College believe that colleges and universities can help develop effective and competent accountants, journalists, chemists, and lawyers, but we would feel more confident if these graduates took with them not only a set of technical skills but also a reasonably well developed set of critical abilities.

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HELPING STUDENTS LEARN TO CHOOSE

- Piedmont Technical College-
Curtis Miles

Historically, a major role of higher education has been to prepare the student to assume a substantive role in the surrounding society. Artist or engineer, politician or financier, business executive of cleric, scientist or rebel, the student could with reason anticipate a not-too-distant time when he or she would participate in significant decisions on a variety of fronts. The society, in turn, could with reason expect the educational process to help equip the graduate with the basic skills and attitudes needed to grasp and make such decisions.

Expanded educational opportunities, instructional techniques and technologies, disciplinary specialization, and the like have undoubtedly provided today's students with many valuable benefits denied their predecessors. It is doubtful whether they have provided graduates with a great deal of skill in pragmatic decision-making. Somehow, two or four intensive years of college education, delivered with the latest technologies by those possessing high credentials, more often than not have inadequately prepared the student for such choices as:

- Deciding whether or not to attach a loved one to medical equipment;
- Taking and adequately defending a position of the safety of and need for nuclear reactors as an energy source;
- Setting up a realistic budget for a family, or for a small business;
- Planning how to locate the fault in a malfunctioning piece of equipment;
- Identifying a good buy in a car, or a house;
- Choosing to take or leave a job;
- Analyzing the issues in the Arab/Israeli conflicts;
- Selecting one of ten applicants for a job;
- Calculating the relative costs of three sizes or brands of a product;
- Planning an efficient itinerary for a trip.

Most students can handle a few of these, depending on their discipline and experiences in college. Research indicates that only a minority of students can -- or will -- try to handle them all. They will ignore them, they will hand them over to "experts," or they will leap at the first choice which occurs to them. At a time when both personal and societal choices are becoming more grave, more complex, and more urgent, there is mounting evidence that college students are becoming less capable of, or at least less willing to, face such choices seriously.

PIEDMONT'S APPROACH

Piedmont Technical College believes that its graduates should be prepared to at least address the above types of choices. Our institutional mission is to prepare graduates for successful careers, we believe that a "career" must directly or indirectly encompass not just technical skills, but also career maturation, academic performance, personal living, and civic/social responsibility. Making choices is a crucial skill in all of these spheres, and one with which we feel our students should be at least fundamentally competent.

Some 2½ years of active exploration and investigation have led to the conclusion that the same sorts of fundamental skills underlie the capacity to deal with all of the types of choices listed earlier, ... and with hundreds like them. The skills needed in determining whether or not to attach a loved one to medical equipment are not essentially very different from those used in troubleshooting a faulty piece of equipment, defending a stand on nuclear energy, or setting up a family budget.

Piedmont's approach to providing our students with fundamental competency in what we call these basic "reasoning" skills focuses on two specific courses (either 3.0 or 4.5 credit hours in duration). The courses have been evolving for over two years through use with some 300 students from 8 different departments. They have been evolving towards a set of nine characteristics. The courses, and the approach to basic reasoning skills which they embody, should:

(1) Be useful - and used - beyond the classroom or course;

(2) Apply to choices arising from career, academic, personal, and social situations;

(3) Be useful independent of any one sequence or way of thinking;

(4) Be useful in open-ended situations, where there is no "right" answer;

(5) Focus on simple techniques, practiced and reinforced in depth (instead of sophisticated, complex techniques touched upon lightly);

(6) Be independent of particular disciplinary content (but hopefully useful with it);

(7) Possess face validity with faculty, administration, and students;

(8) Build on existing student capabilities; and

(9) Be deliverable effectively by part-time instructors from several disciplines.

The core of our course is essentially a method of problem analysis. We teach the students that any substantive choice has at least seven different facets, which are inseparable parts of the situation itself (rather than being factors imposed from outside of the situation). Each such choice, we suggest, contains at least seven factors:

The real problem - those elements of the situation which cause the "hurt" (the disease rather than the symptoms; often different persons will see a situation as having different root problems).

The risks - the probabilities of a negative consequence occuring (a form of "cost-benefit analysis", with different persons having different risks-taking patterns).

The alternatives - the course of action open immediately or in the long run.

The goals/objectives - the sought-for results (either achieving the positive or avoiding the negative; the yardstick by which action is judged in the long run.

The values - the things which the various parties in the situation feel are important, and which often conflict across and within individuals (with conflicting internal values often being much of the "real problem").

The information - the facts, opinions, sources of information, priorities, and methods of organizing the data which are contained within or affect the situation and the choice.

The constraints - the internally, externally, or eternally imposed limitations on actions which are part of the situation and the solution.

We teach the students that any situation contains most if not all of these several factors, that they can be isolated and analyzed in relative separation from each other, and that such an analysis tends to lead to a rational, useful decision. Essentially we teach analysis of these seven points (plus any other factors a student may choose to weigh) to the point of making the choice. The students are free to use the factors in any order that makes sense to them, or to not use a given factor if it seems inappropriate or trivial.

We focus on creating within the student the capacity to analyze any of these factors if the situation warrants it. We spend the majority of the instructional time in exercises which strengthen student ability to manipulate one or another of the factors (e.g. organizing apparently random bits of information about advertising costs and impact across different media into a framework which clarifies a decision). The specific techniques are simple; the emphasis is on practice and application to a variety of different situations. Within this we encourage students to suggest choices which they have faced, or can imagine facing.

EXAMPLE OF APPROACH

An example of the type of situation the class might work on is the following:

Your 70-year-old uncle, who lives with you, has had a severe reaction to a medication. He is unconscious, may have major brain damage, and his physical functions are failing. Your family doctor estimates that he will die unless he is placed on very specialized -- and expensive-- equipment within 24 hours. Your uncle would have to be taken to, and kept in, a hospital 250 miles away. The doctor doubts if he will ever

regain consciousness, but recalls a similar case where partial recovery occured after three years of treatment. You are in school, working full-time, and have a young child. Your family has historically been of little help during emergencies, but full of judgements after the fact. The decision as to what to do is your's.

This particular situation has been very successful with Piedmont students; they become very involved in the issues involved, the information, the risks, and the like. Initially, however, the students approach such a problem as if it were a vast interconnected maze, with information, risks, problems, values, alternatives, and the like all interwoven in a mad tangle. Their attempts to clarify the situation -- the master it -- lead from one thread of thought to another, and on to yet a third before either of the first two can be nailed down clearly. Their thoughts might wander through the maze of facets like this:

> "It will cost so much money...and we have so little...yet how can I think about money when it's my uncle's life...and what will my family say...maybe I should ask them...but maybe he'll survive without the equipment...I wonder what the odds are...who could I ask about that? ...I could ask someone at the hospital...and I could check on costs, too...and I wonder if he has insurance...but I shouldn't be thinking about money...but how about the kids..."

Faced with an important, complex situation where there is not one clear "right" answer, the students' efforts to decide often lack coherence. It is different to grapple with any one aspect because they relate so closely to other vital parts. Normally, our students become frustrated, they often make hasty, unthoughtful decisions out of that frustration, and their confidence in their ability to master such choices diminishes.

The course, however, attempts to prepare the students to separate out and analyze each factor in turn. They learn how to "freeze" a single factor within the maze of facets, to complete analysis of it, and only then to go on to the next factor. They may return to an earlier factor as later analysis gives new insight, but they can do this in a controlled rather than random fashion.

An example of how a student might begin analysis of the medical choice just given follows below. In it, the student has chosen to look at the real problem first. This then leads toward analysis of alternatives, and then to information. The other four factors would then follow, but are not exemplified here. Each student, it must be emphasized, determines his or her own sequence for the seven steps, for each situation.

Step 1: The Real Problem

(1) What are the symptoms? The starting point is that the real problem relates to individual conceptions of what is painful about the situation. From that, the student could ask what the symptoms of "painful" were. He/she might use a stream of consciousness technique, leading to such terms as: fear...pressure...conflict...confusion... anger...fear...worry...hurt...doubt.

(2) What are the fears? Focusing on the symptom of "fear" as being

strongest for him/her, the student might identify fears of: the uncle's death, the family's contempt/accusations, losing his/her savings and house, God's punishment, having to quit school, a life of guilt, having his/her family become poverty-stricken, going broke and having the uncle die anyway.

(3) What are the conflicts? After analyzing the fears that were revealed, the student might discover that they were really of two types, and that they conflicted. He/she might clarify things as a conflict of fears between:

- the loss of a loved one, the family's and church's judgement, the inner guilt, and God's punishment...

versus

- loss of all savings, debt, quitting school, having the family poor, loss of comfort and status, etc.

(4) What is the real problem? From such an analysis, the student might come to perceive that for him/her the real problem could be stated roughly as:

> "I have to either face guilt, shame, and "killing" someone I love, or risk a "ruined" life for me and my family without perhaps helping him at all. The conflict seems irreconcilable, and I cannot accept either!

Several points should be made about this scenario. First, it can be either quick or a slow, methodical process. Second, this is but one approach among many. Third, each student may end up with a very different statement of the "real problem." Fourth, and most important, this interim statement of the problem is a directly useful method of shifting into analysis of other factors. An assessment of "risks" would become very pointed, rather than general, given this statement of the problem. The types of information needed become more clear. The constraints begin to take on substance. And the like. The first factor to be tackled (no matter which it is) helps clarify the configuration of the next, until all are completed to the point of choice.

Step 2: The Alternatives

The student becomes urgent to find an alternative that escapes the dilemma. Initially, he/she may simply identify two alternatives: attach him, or don't attach him. Analysis of the problem statement, and an effort to get around the apparently "irreconcilable" nature of the choice, might lead to identification of many variations:

- Attach him until we run out of immediate cash;
- Attach him until we borrow and sell all we can;
- Attach him until we use up 50% of our savings;
- Attach him until he dies, no matter how long it is;
- Attach him until the odds of recovery drop below 10%;
- Attach him for two weeks...for two months...etc.

The statement of the real problem serves to guide analysis of the alternatives in two main ways: it gives urgency to the search for more choices, and it guides the direction of the search (i.e., towards alternatives which reconcile the conflict). The alternatives in turn lead toward a next step, for the student becomes concerned to seek information related to the alternatives that were open.

Step 3: The Information.

(1) What missing information is needed. The student's inspection of the problem statement and alternatives suggest an immediate need for information concerning such things as: cost of equipment, hospitalization, medications, special care, etc.; insurance coverage; governmental assistance; the odds of long-term and short-term recovery; the church's position; the family's opinion; etc.

(2) Where can I get the information? The specific statements of information needs can then fairly readily be tied to such specific sources as medical specialists, pastor, hospital administrator, family opinion leader (Aunt Helen), insurance agent, bank, articles and books, etc.

(3) How do I organize the information? Before, during, and after the information-gathering process the student prepares and uses a scheme for organizing the information in some useful manner. For example, the student might contrast each item of information with all major alternatives in a matrix form, to assess its relevance and "message" (e.g., "insurance coverage will run out in about three weeks of full treatment" will argue for some alternatives, and against others).

Again, this process is guided by the preceding analysis. Instead of randomly collecting all conceivalbe information about the situation, the student is guided by the statement of the problem and the major reasonable alternatives, both in choosing the information to get and in making subsequent use of it. The process can be as brief or as lengthy as is reasonable; when it begins to become trivial or rote, then it should be terminated (at least for a while).

The process can continue through all or most of the seven factors, until each substantial part of the maze of factors is clarified to the point where the "best" (or perhaps "least bad") choice becomes clear. As needed, analysis of a later factor can cause re-analysis of an earlier one (e.g., information from a surgeon may reveal additional, unsuspected alternatives).

INDICATORS OF EFFECTIVENESS

Piedmont has coordinated substantial parts of its evaluation efforts with some 8 other colleges and universities over the past two years. Such efforts have been primarily formative in nature, and almost exclusively dependent upon locally-developed measures and instruments. No standardized test has been discovered which focuses on the type of reasoning skills which are central to our approach, and which is sensitive enough to measure cognitive change within a one-quarter time span. Some indicators of effectiveness, however, are as follow:

-- 103 students rated the reasoning course as "learned a lot" (7.5 on a 9-point scale)

-- 87% of students surveyed indicated that all students should learn these basic reasoning skills as part of their college experience.

-- 11 different instructors from 9 disciplines have taught the course successfully, and have been from mildly to very strongly positive about it.

-- About ¼ of Piedmont's faculty have been involved in either the reasoning courses or in offshot activities involving the relationship between thinking and learning.

-- Piedmont has administratively created a Center for Reasoning Studies to continue research into these fundamental skills and to coordinate related efforts within the institution.

-- Three grants (FIPSE, NSF, EXXON) have been obtained to support instructional development work related to reasoning skills.

We do not feel completely satisfied with all aspects of the reasoning approach and courses. Recent evidence suggests that students who are intensely oriented towards their discipline (and related careers) question the relevance and importance of the materials. There is a constant effort to determine whether the level of difficulty of the course is appropriate for Piedmont's students (sometimes it seems too hard, sometimes too easy). Practice exercises in certain areas need strengthening, and some other basic course activities may be tried.

We do, however, believe strongly that some such reasoning course, or equivalent material inserted into other coursework, are highly beneficial to our students, and are a clear part of our institutional responsibility to adequately prepare our graduates for effective adult living.

SUMMARY

Piedmont's approach to teaching students to make more effective choices is based upon a guided, yet relatively free-form, analysis of the choice situation in terms of some seven factors. We believe that an inability to separate one factor from another leads to frustration, to random choices, and to a loss of confidence in one's ability to deal with a complex or conflicting choice. We believe also that the variability in both situations and individuals makes it of limited practical value to teach students a single set of decision-making steps, to be applied in the same sequence and to the same degree in all circumstances.

Rather, our approach is to teach the students to break the maze of open-ended choices into about seven parts, and to tackle each part separately. The students themselves choose where to start, and what follows, according to their individual judgements as to what "makes sense". They are similarly free to cease working on a step when it begins to appear trivial (or insurmountable) to them; they may or may not return to it later. They are given specific techniques to use in analyzing each factor, and are encouraged to come up with their own techniques. They apply one technique or many to a variety of situations, drawn from career, academic, personal, and social circumstances. They are encouraged to try out the methods they are learning with the choices they themselves face, in class or privately.

Perhaps the most pertinent analogy might be the tools of a carpenter. The students are taught that solutions are erected in stages, they are shown the stages, and they are familiarized with some basic tools pertinent to each stage. What they then proceed to build, and how they build it, becomes their choice, as it will be for the rest of their lives.

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DOORS PROJECT

DEVELOPMENT OF OPERATIONAL REASONING SKILLS

Illinois Central College
East Peoria, IL 61635

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The DOORS Project in Perspective

The two year DOORS project at Illinois Central College has addressed a basic issue in higher education: low level student reasoning abilities. As stated in the original project proposal, the major objective of the project was to:

> .....develop and teach a multidisciplinary freshman program at Illinois Central College. This program will focus upon the improvement of student reasoning skills.

Recent research dealing with the low level of student reasoning via Piaget's Model of Intellectual Development shows that as many as 50% of incoming freshmen are concrete operational thinkers.

The problems resulting from the low level of student reasoning are varied. They include inefficient remedial programs, high class attrition frequency, and low academic success. This project addressed these problems by creating a new core academic program for freshmen at ICC. The essential features of this new core program were aimed at developing student reasoning abilities. These features included experimental based learning activities, integrated class content, stress on participation/attendance, and emphasis on process rather than content attainment.

At the center of the DOORS effort has been the psychology of Jean Piaget. His work with children of all ages has resulted in the documentation of a developmental model of intellectual growth. With the help of ADAPT (Accent on the Development of Abstract Processes of Thought) at the University of Nebraska, Piaget's model was utilized extensively in developing all classroom materials for use in the DOORS classes.

Piaget's developmental theory of intelligence offers a unique approach to the problems associated with low cognitive functioning. In a "nutshell," his view of intelligence is developmental, progressing through several recognizable stages. Each stage has been shown to be a prerequisite for the next stage. In a recent article, Fuller, Karplus, and Lawson (1977) outlined the prominent characteristics of the final two stages of development, concrete and formal.

In Concrete Reasoning, a person

- needs reference to familar actions, objects, and observable properties;
- uses classification, conservation, serial ordering and one-to-one correspondence in relation to concrete items above;
- needs step-by-step instructions in a lengthy procedure, and
- is not aware of his own reasoning inconsistencies among various statements of contradictions with other known facts.

In Formal Reasoning, a person

- can reason with concepts, relationships, abstract properties, axioms and theories;
- uses symbols to express ideas;

-applies combinatorial, classification, conservation, serial ordering and proportional reasoning in these abstract modes of thought;
-can plan a lengthy procedure to attain given overall goals and resources; and
-is aware of and critical of his own reasoning, and actively checks on validity of his conclusions by appealing to other information.

Since the mid-60's, Piagetian studies of cognitive thinking strategies have consistently found less than half of all entering college freshmen operate at a formal reasoning level. Comparable assessment of community college students suggests that fewer than 30% are formal in the use of proportional reasoning. The problem, from this unique viewpoint, is a basic one--most beginning college students, who are expected to be capable of abstract thought, either operate at the concrete level of reasoning or do not consistently evoke and use formal thinking strategies consistently.

The essence of Piaget's work is rather complex for the average faculty member to understand and to adapt to his teaching. Therefore, a paradigm derived from Piaget's work by Karplus (1968) called the Learning Cycle was adopted for use. All DOORS staff members were introduced to the essential features of Piaget's model and the Learning Cycle through intensive workshops at the University of Nebraska at Lincoln in August of 1976. A more in-depth discussion of the Learning Cycle is presented in Appendix I.

During the fall semester of 1976, the DOORS staff (six teaching faculty and director of counseling) met together in a weekly seminar to discuss both the scope and direction of the DOORS project. Although the project was to be patterned after the ADAPT program in Nebraska, the needs of the community college students were perceived to be much different. Whereas the Nebraska program required all ADAPT students to enroll entirely in the program for an entire year, the DOORS faculty felt this model would not suit the target DOORS population.

After considerable discussion it was decided that the program would be one semester in length and students would be required to enroll in both DOORS English and DOORS Mathematics and then select at least two additional DOORS courses from the following choices: economics, sociology, history, and physics. The predicted target population for this program had the following characteristics:

1. Beginning students with undefined career goals.
2. Beginning students with average to just below average high school academic records/classwork.
3. Older, returning students who are beginning their college careers.

The weekly seminars proved to be very productive. At each session, individual staff members discussed their specific learning cycle plans. As these were presented, other faculty would respond with constructive criticism. The result was two-fold. First, participating faculty felt pressure to continue to develop curriculum materials which were parallel with Piaget's model.

Second, an interpretation of the content (each knowing what the other had planned) and reasoning required for each classroom experience was a natural occurrence. Through much interaction, a rearrangement of the order of topic presentation by each staff member produced a cohesive curriculum.

In January 1977, the first DOORS program was offered to ICC students. Some difficulties were encountered in offering this program at the beginning of the second semester--most of the courses were first semester courses, designed for beginning students. Not many new freshmen were available; however, 32 students entered the program--14 qualified as full time DOORS students and completed bothe the pretest and posttest evaluation instruments.

During the summer of 1977, the DOORS staff again utilized the seminar method to review and revise their curriculum macerials. Through our experience, we realized that our efforts were not appropriate at integrating the DOORS content to make the program "interdisciplinary." In reviewing our experience, we realized that the program was really "inter-skill" and should be integrated through the parallel use or emphasis on reasoning skills. Again a thorough review of our materials revealed this to be a most satisfactory method for interrelating the various disciplines.

To expedite this reorganization, the DOORS staff identified several major thinking skills basic to the six disciplines. As this task was completed, these skills were arranged in a natural ascending order. Each of the DOORS classes was then redesigned to emphasize the same skill at the same time in the semester. A brief outline showing this skill identification and emphasis schedule for the first seven weeks of the semester is shown below.

Reasoning Skill Identification

Week	English, History, Sociology	Math, Economics, Physics
1.	Observation (Identification of variables)	Observation (Identification of variables)
2.	Description (Describing variables)	Description (Describing variables)
3.	Comparing or Relating (comparison and contrast)	Comparing or Relating (graphing)
4.	Comparing or Relating (comparison and contrast)	Inferring (graphing)
5.	Classification	Classification
6.	Classification	Separation and Control of variables
7.	Summary	Hypothesis Statement
8.	Cause and Effect	Separation and Control of variables

9-15.	More advanced use of Skills	More advanced use of Skills

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